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Administrators for the Future -- The University Role

In recent years, we have experienced a profound change in the essential nature of the problems that confront all levels of government. This does not mean that the traditional problems have gone away. Education, public transportation, law enforcement and welfare are continuing concerns of state and local governments, and at the federal level, there is still major emphasis on national defense, social programs and public works.

But these concerns have now been joined by a host of new problems, different in origin, different in character, and not amenable to traditional solutions. Today, governments struggle with urban congestion and snarled transportation systems. Municipalities, not just in the United States, but all over the world, are casting around for ways of checking inner city decay. Pollution and environmental degradation threaten areas of population density. Problems of energy generation can be foreseen, as can the depletion of our limited stores of natural resources. The prospect is that concerns like these will increase in number, kind and intensity.

It is vital to recognize that all of these problems are strung on a common thread. They are socio-technical in origin. Logically, therefore, they will require socio-technical solutions. They cannot be traced to discrete technical actions which, if reversed, would eliminate the problem. Nor can the corrective be supplied by simple legislation.

In their recently publicized studies of World Dynamics, Forrester and Meadows, at MIT, assert that the world is facing disaster in the years ahead unless both population growth and economic growth are checked very soon; and they feel that reversing these current problem trends may be difficult indeed. Alternatively, Barry Commoner argues that we are simply victims of a possibly reversible "Social Style." Whichever judgment is the more valid does not alter one inescapable fact: more and more science and technology will have to be applied -- with wisdom and understanding -- as a part of any governmental programs instituted to cope with such problems.

Except for national defense, science and technology have played only a minor role in government's dealings with its problems in the past. As these factors gain increasing significance as a part of the solutions available to governments, it inevitably follows that an urgent need will be created for a new breed of Public Administrator. He will be what might be called a "hyphenated" professional: one who understands both science and Public Administration. Let me add one more hyphen for good measure: Technology.

This need raises several points that warrant discussion. You will notice -- and perhaps I should have underscored this at the outset, that science and technology will be only a part of the remedial program. They will not be the whole solution because they are not the whole problem.

The urban transportation tangle is a case in point. This problem plagues all of our cities, whether it is a New York City honeycombed with subways, or a sprawling Los Angeles that is virtually devoid of a coherent public transportation system. Their common denominator is that both are clogged with automobiles. The consequences are also the same: first, average rush-hour traffic speed is barely comparable with late 19th century rates; second, combustion products form the major inputs to growing atmospheric pollution.

At first blush one is tempted to say, "If this be progress, then progress be damned. Get rid of the automobiles!" Upon reflection, however, the traffic and pollution problems are associated with an important kind of progress -- social flexibility.

The low-cost automobile freed man from the vertical confines of the city and extended his mobility beyond the ends of the hard-rail transportation systems. For the first time he could live in one locality and work in another. The family car spawned suburbia and exurbia, but it did even more: it gave a time-flexibility to man. An individual's travel no longer had to be governed by someone else's time-table. This is a freedom that we should not underestimate. Think how much of our congestion is caused by automobiles occupied by the driver alone.

With all these factors to be considered, the ultimate solution of the traffic congestion and smog pollution problem in itself becomes hazy. Obviously we have a sociological as well as technological dimension to the problem. We can, and should apply new technologies to reduce automobile emissions. This, however, will not necessarily curb congestion.

We can, and should, consider new and more flexible mass transportation systems that will meet sociological needs. We may want to encourage the use of public transportation by placing an economic penalty on private cars in certain sections of our cities, or by negating the time-flexibility advantage through tight parking restrictions. The nature of the problem is such that no single approach will suffice.

Most of the other major problems are a mix of sociological and technological components. It is this hybrid quality that raises them to a new level of complexity.

A public official so equipped will recognize that the introduction of science and technology into the processes of government forces a re-orientation of both outlook and practice. Such an administrator well understands that science and technology projects demand a vigorous and continuous logic from their conception to their completion. Objectives must be clear. Schedules must be complete. Interacting milestones and decision feedback points must be clearly identified. A manager who does not comprehend and implement these principles will face a high probability of having his project meet with fiscal or functional failure.

If the sole issue confronting our governments were simply to introduce, comprehend, and implement sound technical management and administrative practices, I do not think preparing future Science-Administrators would be unduly formidable. We have had extensive and successful experience within the DoD, AEC, and NASA, for example, in managing major technological developments and deployments. The management-administrative expertise developed within these agencies is being reduced to textbook practice; the principles and practices are thus becoming available for training future practitioners.

Within the NASA program, for example, the management systems, techniques, and organizational principles that contributed to the successful conduct of the Apollo program -- the most complicated and difficult technical task ever undertaken by man -- have been and are being documented and analyzed by a number of Management and Public Administration research teams. I am sure that the techniques and methodologies will prove extremely valuable in shaping the conduct of other governmental technical activities of far lesser scope. But -- and this is a major qualification -- in Apollo we were carrying out a highly complex, but basically technical program. Essentially we were dealing with machines, not people.

Because Apollo could be treated as a technical program, we could make optimum use of management principles and techniques. Indeed, they were almost mechanistically objective. We were able to organize and reorganize to accommodate the developing technical concepts. We could delegate, evaluate, and decide in terms of technical performance standards. In short, we were able to develop and operate a highly authoritative, almost autocratic management system; and it worked very successfully in the framework of the Apollo program.

I do not think that we can, or would want to transfer that whole Apollo management concept to the solution of socio-technical problems. A comment by Astronaut Frank Borman during Apollo 11, the first landing on the Moon, expresses my feelings. A television interviewer said to Frank, "Don't you think the country should take the approach demonstrated by Apollo to solve its air and water pollution, transportation, housing problems, and so on?" Frank wisely replied: "I don't think that I would care to live in a country that solved its social problems in the same way we solved the Apollo problems."

Because of the socio-technical intertwinings of the problems that we face, our Science-Administrator needs for the future should not be equated with needs for better technical program managers, although this too will become increasingly important.

In developing and formulating wise and sound policies and programs to tackle our emerging problems, it will be essential to have individuals within all governmental levels who are capable of understanding the potentials of science and technology on the one hand, and who are alert to their ultimate purposes and consequences on the other. It is in this role that I conceive of the new Science-Administrator.

Effective management requires simultaneous consideration of science with human needs as they interact to create new dynamic situations; these may create new problems or compound the difficulty of finding satisfactory solutions. Indeed, it may be necessary to go even further and consider also the pervasive interplay between problems whose initial relationships may have been quite tenuous.

While we can admire the clean energy benefits of electricity at the user end, we cannot ignore the growing thermal pollution, air pollution or nuclear waste problems at the generator end. We can improve our food production, wash our clothes whiter, and enjoy the blessings of a plastic economy through advances in polymer chemistry, but we must also reckon with the accumulating effects of non-biodegradable products in the waste cycle. In short, to use the engineering jargon, our "societal interfaces" are becoming increasingly interdependent, and solving one problem may create another, or more than one.

This factor will contribute to the magnitude of the tasks demanded of future Science-Administrators. Whether we think in terms of a Technology Assessment function or of a comprehensive Systems Analysis function, we will have to consider broad implications of possible courses of action; we must weigh the benefits gained by solving one problem against new problems the solution may create. Ultimate decisions must be made to achieve the greatest common good or least common harm; they must also ensure that a net common good will in fact result. This dictum should be true for future problem solving in general, but it will be particularly necessary when large-scale science and technology form part of the problem solution.

I would observe that the time constant for reversing bad technical decisions, once they have been translated into hardware, can be very long indeed. People seem to be able to write off social programs after billions are expended, but they are very loath to give up physical facilities that are measured in the millions. As a case in point, I would cite the Aswan Dam in Egypt. I am obviously not trying to make a final judgment, but from all indications some of the effects of the dam are going to make its ultimate value questionable. The ecology of the Nile is being drastically changed, both above and below the dam; the fishing patterns in the Mediterranean Sea have been altered; and it now appears that a large fraction of the dam's electrical output will have to be employed to produce artificial fertilizers, in compensation for the nutrients lost through control of the annual Nile flood. Regardless of its net advantages or disadvantages, however, I believe it can safely be said that the Aswan Dam will never be voluntarily dismantled. Whatever its ultimate consequences, Egypt and the whole Mediterranean basin will be living with it for centuries to come.

On the other hand, there are numerous examples of social programs that have eventually been written off without a qualm, or at least totally revamped. One might mention the CCC, the NYA, and the WPA of the depression years. In our own time, we are finally beginning the long overdue revamping of a welfare program that has cost billions and served inadequately those it was designed to help. Apparently white elephants in physical or technological terms are much more visible and therefore a bit harder to scrap.

We have had minimal experience in making the kinds of complex, interactive decisions which will exert very long term impacts. In fact, we have tended to avoid making decisions that have any identifiable detrimental aspects, regardless of the greater positive values that would accrue. I submit that we will not be able to continue this practice, and that we will have to face up to some very tough decisions indeed, if we are to cope with the growing congestion, pollution, and ecological problems that are a consequence of our national growth and the life-style to which we have become devoted. The massive deployment of science and technology that will form a part of our solution to these problems will exert a long term impact on our future, and we had better be geared up to making sure that that impact is foreseen and desirable. We had better be sure that we don't have any Aswan Dams in our future. We can lose either way, however, by not fully assessing the future impact of our solution, or by avoiding or fatally postponing a decision because of inability to make a satisfactory assessment, thereby accepting the consequence of indecision The second danger seems to be dominant lately because of exaggeration by a few professional doom-prophets.

I've offered some positive views on the kinds of increased science and technology interaction that I think is inevitable in future governmental activities. I've also sketched some of the formidable qualifications that we are going to need in the administrators of those activities. Let me now advance some concepts on the role of the universities in preparing this new breed of Science-Administrators.

C. P. Snow has been writing about the problems we are now discussing since 1959, when he published his seminal Rede Lecture, "The Two Cultures and the Scientific Revolution." The subject obviously has a continuing fascination for him, since he returns to it at intervals -- most recently in a book entitled Public Affairs, published last year, which collects and culminates his rationale.

By his own admission, Lord Snow has grown increasingly pessimistic. He has not altered his originally stated belief that technology brings both "blessings and curses," but that "The only weapon we have to oppose the bad effects of technology is technology itself." He feels, however, that in recent years we have made fewer gains than losses.

About one of his prime concerns -- the threat of thermonuclear war -- he is somewhat sanguine, feeling that the danger has lessened. But his other two major worries -- the gap between the rich and poor countries, and the menance of overpopulation -- are in his opinion growing worse. Even while admitting that the Green Revolution has given us a partial technical solution to the food problem, he calls it "a qualified success," and adds that "it is unrealistic to believe that food growing can be increased indefinitely."

In many ways Public Affairs is a most depressing book. But Lord Snow strikes one small note of hope. In the last paragraph of his "Epilogue," he tells us of how he gains some emotional "courage from the attitude of the educated young." As he puts it, "They are far better prepared for the future than we ever were." And he concludes, "...if I can find any source of hope at all, it lies in them."

I do not think we need be totally weighed down by his pessimism, although it is good for us to be aware of it -- and of his reasons for it. I do agree, most heartily, that the "educated young" are our best hope for the future. For it is obvious that it is this generation which will supply the "hyphenate" professionals that we have been talking about.

The major difficulty that I foresee is in the establishment of an effective motivation and training mechanism for the young.

I think the universities must be a basic and extremely important part of the training process. The complexities and consequences of science and technology decisions in the governmental processes of the future will require professionally trained decision makers. We already accept and expect this for the scientists and engineers as technicians. I do not think we will be satisfied with our ultimate decisions unless our future Science-Administrators have equally specific and intensive training for their larger functions

This audience, of course, recognizes the need for professionalization of Public Administration in general. What I am suggesting, however, is that the Science-Administrator role in the future will increasingly demand a level of formal education and training not now generally emphasized. This will occur because of the hyphenated duality of his role.

Hyphenated professionals are no longer a rarity. I read an article in SCIENCE magazine sometime ago written by a professor of mathematics, electrical engineering, and medicine. All one man!

The assets offered by the Engineer-Business Administrator, and the Engineer-Law graduate have been recognized for some time. I understand that the Scientist-Physician and Engineer-Surgeon are increasing in numbers. There is, therefore, a precedent for a formally trained Scientist-Administrator or Engineer-Administrator to fulfill the functions that I have been discussing. I think that there will be one significant difference, however.

Most of the hyphenated degree-holders that we're now familiar with receive their several degrees back-to-back in an extended educational phase before they begin professional practice. This is probably because young people recognize and accept the economic as well as ego-satisfaction values of the dual background. I doubt, however, that many budding scientists or engineers will consciously anticipate assuming administrative responsibilities. They may very well consider careers with Federal, State, or local governments, but they will almost undoubtedly be thinking as practicing technicians; they will view such openings as competitive with those in the private or educational sector. Conversely, I doubt that many undergraduates who enroll for Public Administration degrees will feel motivated, or capable of taking a second degree in science or engineering before they enter the world of work.

Clearly, we must look to the universities as training sites, but with a significant alteration in their structure. The acquisition of a degree, or degrees, in science or engineering, would be unchanged; although I have stressed the balancing societal concerns that will exacerbate major problem solutions. I advocate this because I view the proper introduction and use of scientific concepts as the governing aspect of much of our future problem solving. If we are to have program administrators who, first of all, will understand, appreciate, and welcome the possibilities afforded by science and technology, they will have to be scientists or engineers in their own right.

Following a few years of work experience which should help identify specialists who have the native equipment for a broader administrative role, there should be an inducement for them to return to a program of graduate study especially designed for the mid-career executive. This should include at least a year, perhaps two, of the kind of intensive, total immersion training represented by most of our better graduate Business Administration schools or schools of public administration.

There is a further step that might be worth considering. The mid-career training program will provide an administrative foundation for the hyphenate professional. But it might be in the public interest to provide for a high-level training for those who show particular talent. (Analogous to a company "charm school" for large industry business executives or War College for general officers.)

However we do it, I believe that the wise course is to make a positive and concerted effort to establish a training ladder that will make sure that our best talent is fully developed. This is too important to the nation's future to assume that the most gifted will reach the top level by natural processes. The mechanism for establishing the training ladder had best be left to the universities, but whatever steps we decide to take are perhaps less important than the decision to take them -- and take them soon.